



Keep Your Pond in Good Condition

Marley Beem

Assistant Extension Specialist, Aquaculture

Watershed ponds are a common part of the Oklahoma landscape. Unfortunately, most pond owners do not know how to inspect and maintain their ponds. Without maintenance, pond life is shortened and major repairs are often needed. This Fact Sheet aims to provide a simple set of steps to ensure the investment for the pond is protected. Taking the time to do regular walking inspections of your pond will pay off by catching problems early, when repairs are much less expensive.

Recognizing pond problems early does not take long and should be a part of your yearly calendar. It begins with understanding the parts of the three major parts of a pond: the dam, watershed and basin.

A checklist is included at the end of this fact sheet to copy and use as an inspection guide. Keep a notebook of these completed checklists along with photos and other information to help recognize slowly occurring changes that might be otherwise missed.

When inspecting the pond, it is recommended you take along the following items:

- Survey Flags, Flagging or Stakes - to mark any problem, making it easy to relocate.
- Camera – to show an engineer or technician exact concerns.

The Dam

The force of water pushing against a dam is enormous. Even a well-built dam is vulnerable to failure if not maintained. The final stages of a dam failure happen quickly and can easily destroy buildings and kill people or livestock unfortunate enough to be in the way (Figure 1).

If the opportunity to build a new dam exists, consider spending more money and time to have a wider top and gentle slopes. A wider top will greatly reduce the chances of pond blowouts due to animals burrowing and other factors. Gentle dam slopes allow safer mowing. Mowing once or more a year is one way to prevent damage due to brush and tree growth (Figure 2).

The crown or top of an earthen dam should be maintained to slope away from the center line to shed water. A poorly maintained crown can lead to water overtopping the dam, leading to a complete dam blowout.

Potential problems with dam crowns

- Not higher in middle to shed water, allowing water to puddle.
- Ruts from vehicles or cattle trails.

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: <http://osufacts.okstate.edu>

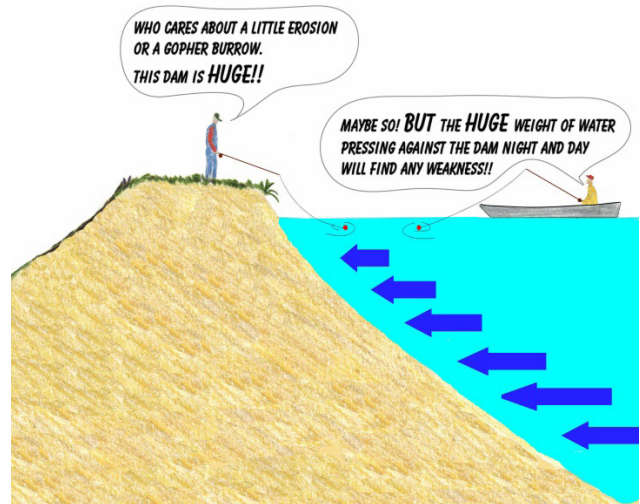
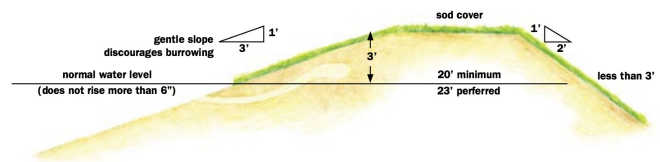


Figure 1. Any weakness in an earthen dam can lead to a catastrophic failure of the structure.

Proper Embankment Construction



Improper Embankment Construction

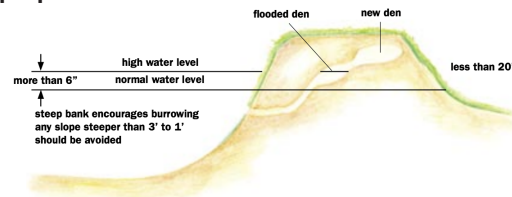


Figure 2. A properly designed dam with gentle slopes and a wide top will pay off in ease of maintenance, less potential for erosion and less likelihood of serious animal burrow damage leading to dam failure. (Courtesy FEMA)

- Vehicles should not be driven across a dam unless it has a very wide top designed for this purpose. Dams designed for vehicles typically have a 25-foot or wider top. In addition to creating ruts, the weight of vehicles will cause the shoulders of the dam crown to slump, leading to a narrowing of the top width.
- Grass cover too thin to prevent erosion.
- Slumping or eroding shoulders.
- Animal burrows – mounds, tunnels and collapsed areas.

For advice on recognizing and managing nuisance burrowing animals see [FEMA 473, Technical Manual for Dam Owners: Impacts of Animals on Earthen Dams](#). Mounds indicating gopher burrowing are easily seen. Muskrat and beaver activity may be harder to recognize, since burrow entrances are below the waterline. Before attempting to repair the burrow, the nuisance animal must be eliminated using appropriate methods of the type discussed in FEMA publication 473.

One possible repair method for small burrows is a thick slurry mix of 90 percent soil and 10 percent cement. Do not make the mix too watery. Use just enough water in the mix to allow the slurry to flow into the burrow. Insert a metal stove or vent pipe into the burrow entrance, seal the area around it well and then use it to funnel the mix into the burrow. Also be on the lookout for collapsed areas that may indicate beaver dens in the crown of the dam. These typically require digging out and repacking with good clay soil. As always, seek the advice of NRCS professionals.

Slopes

There are two slopes or “faces” of the dam: the upstream and downstream sides. Grass can hide problems, so a close walking inspection is needed to cover the entire dam face to inspect the slopes for the problems discussed next. Use the walking pattern best suited for your dam as recommended in Figure 3.

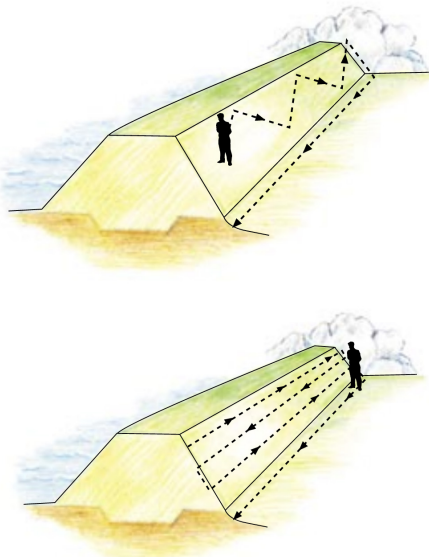


Figure 3. Suggested walking patterns for inspecting dam slopes. Upper image shows how best to inspect small dams and mild slopes. Lower image is for dams with steep slopes. (Courtesy FEMA)

Potential problems on dam slopes:

- **Wave erosion on inside face** – seek NRCS advice. Wave erosion solutions may involve hardening the eroding area, use of floating barriers to reduce wave impact or establishment of emergent aquatic plants.
- **Animal burrows** – mounds, tunnels, collapsed areas, and paths in vegetation indicating underwater burrow entrances. The characteristics of beaver, muskrat and gopher burrows are shown in Figures 2 and 4.
- **Trees or woody plants** – If these are large, seek NRCS advice. Otherwise remove by cutting and/or use of herbicides as most appropriate. Apply herbicides according to the label. Removing large woody plants can weaken a dam if roots are not removed and the hole properly repacked (Figure 5). Seek expert advice.
- **Grass cover** – too thin to prevent erosion.
- **Cattle trails or bare soil.** Fence cattle to keep them off the dam and take steps to reestablish good grass cover – seeding or sprigging and soil amendment and irrigation if needed.
- **Cracking or slumping** – flag and take photo. Beware of the possible danger if a section of the dam face breaks loose and slides
- **Excess seepage** – If a new damp or wet spot is seen, flag it. A new wet spot could be a serious warning sign—seek advice.

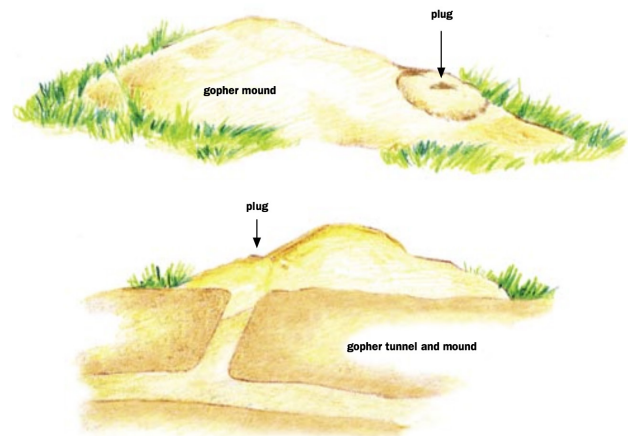


Figure 4. Characteristics of gopher burrows. (Courtesy FEMA)

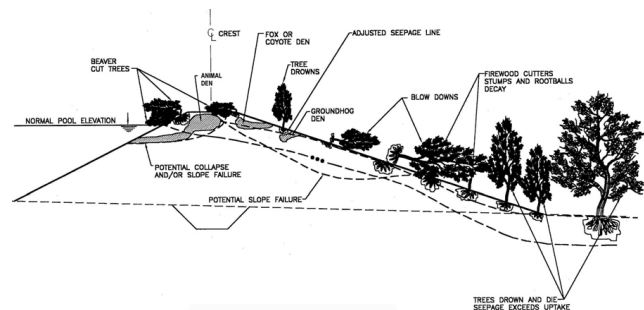


Figure 5. Trees are the leading reason that earthen dams are condemned during inspections. Blown down trees and decaying tree roots can greatly weaken dams leading to their failure. Animal burrows raise the risk. (Courtesy FEMA)

Primary spillway

The primary “spillway” of a pond is the first place the pond overflows. It may be a pipe a few feet below the top of the dam that runs through it (trickle tube) or a vertical pipe on the inside of the dam (internal standpipe) or a concrete tower, in the case of large flood control ponds (Figure 6).

In larger ponds, there is often an open cage of rods (trash rack) on top of the primary spillway. These work to prevent clogging of the primary spillway by floating tree limbs or other debris.

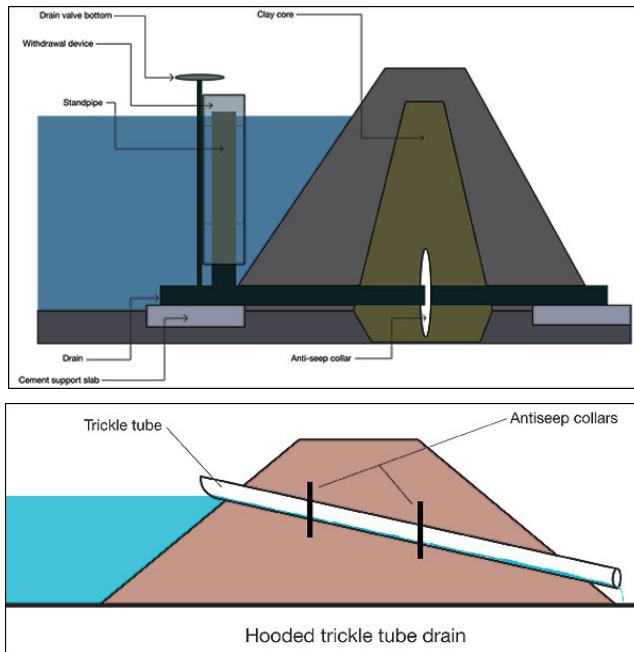


Figure 6. An internal standpipe (top) and trickle tube (bottom) are both examples of primary pond spillways. (Credit: University of Missouri Extension publication G9474)

Potential problems with primary spillways:

- No trash rack – potential for clogging by floating trees limbs or other debris. Beware of the lethal hazard posed by an overflowing primary spillway. Never attempt to unclog a large spillway pipe or tower while swimming or from a boat. Do not get anywhere close to the intake.
- Signs of damage to the pipe or tower – corrosion, collapse, etc.

Auxiliary spillway

Once the capacity of the primary spillway is exceeded, the water level rises and the flow begins across the auxiliary spillway. This structure used to be called the emergency spillway. Usually it is a broad, flat channel to one side of the earthen dam. Good grass cover is essential to protect against the erosive power of flowing water.

Potential problems with auxiliary spillways:

- Inadequate grass cover to prevent erosion.
- Rutting by vehicles or livestock.
- Erosion – check entire spillway for eroding areas, especially the outside toe.

- Blockages or other changes – these could prevent proper functioning.
- Nothing should be done to the auxiliary spillway that will block the free flow of water during an overflow event. Auxiliary spillways are to be flat from side to side to allow uniform depth of flow. They should never be modified or blocked without expert guidance.

The Watershed

This is the area of land that catches the rainfall to fill the pond. Typically, it will be 10 or more times larger than the pond basin (Figure 7). It often will include other people's property so close inspection of the total area is not possible.



Figure 7. The area of land that slopes towards the pond is known as the watershed. Get to know the boundaries of your pond watershed so you are aware of any problems that might harm the pond. (Credit: Winfield Fairchild, Ponds of Chester County, Pennsylvania)

Potential problems in pond watersheds:

- Grass cover - lacking, inadequate or adequate coverage to prevent erosion which will muddy ponds. In some cases it may be useful to build a small sediment entrapment pond above the pond.
- Dirt roads can be a major source of clay, silt and sand washing into ponds.
- Oil field activity – salt water, drilling mud or oil can impact ponds downslope if something goes wrong.
- Fertilizer use – When applied to lawns or crops in excess of plant need, fertilizer runoff can lead to pond algae problems.
- Animal manure – corrals, storage piles and application to land in excess of soil test recommendations can lead to pond algae problems.
- Trash dumps – may release toxic substances.
- Ponds that drain into a pond – undesirable fish can move into a pond when higher ponds are overflowing.

The Basin

The basin is the “pool” part of your pond. The soils in a properly planned pond basin should have adequate clay content to retain water with minimal seepage. Rock layers and pockets of sand or gravel can create problems by allowing high rates of seepage. Seek advice if the pond basin does not hold water. There are many reasons why a pond basin may not hold water and multiple ways to correct these problems.

Shoreline

Basins are vulnerable to being filled in by soil that washes into the pond and to shoreline collapse, slumping or erosion. The greater the exposure of a basin to wind, the more energy waves will have to erode shorelines. Aquatic plants prevent edge erosion by dampening wave energy and holding soft shoreline soils together with their root systems (Figure 8)

Potential problems with pond shorelines:

- Sediment filling – sand and silt has washed into the pond.
- Edge slumping or collapse.
- Edge erosion.



Figure 8. A shoreline that is well protected against erosion by aquatic plants (left) and one in the early stages of serious erosion, due to lack of aquatic plants (right).

Aquatic plant coverage

Unlike brush and trees on dams, aquatic plants are needed in a pond in moderate amounts. Learn the names of the common aquatic plants in your pond so you can recognize when a new, potentially damaging plant appears. There are three categories of pond plants based on where they grow:

- Shoreline emergent plants may be tall or short. They do an excellent job of protecting against wave erosion. Tall shoreline emergent plants can block the view and access to the pond.
- Submerged aquatic plants are desirable for fish populations. They offer shelter for small fish to escape larger fish

and create habitat for insects for food. From a fishing point of view, the optimal amount of submerged plants is from 20 percent to 30 percent of the pond basin. They also help to oxygenate the water. Submerged plants become a problem when they interfere with casting by anglers or take up the majority of the pond volume.

- Floating plants become a problem when they cover all or most of a pond, preventing the light penetration needed to produce oxygen through photosynthesis. Seek help in identifying plants and managing them by contacting the local county Extension office.

The process of ponds becoming choked by excessive aquatic plant growth usually happens over several years. Do a yearly plant coverage check to recognize a problem in the early to middle stages, when it is much easier to manage. Pick a month in the growing season and get in the habit of doing a check on plant abundance each year at that time:

- Take a photo from the same spot or make a sketch every year of the areas covered by plants,

OR

- Estimate the percent of the pond that is covered. This will let you recognize when a problem is developing. Do this during the growing season and during the same month each year,

OR

- Draw a bird's eye view sketch of the pond showing the area covered by these three plant types.

Water appearance

The appearance of the pond water can indicate problems with excess fertilizer runoff into the pond, watershed erosion, leaf accumulation or other issues. Seek advice from the local county Extension office. Note the water's appearance:

- Clear
- Greenish - Estimate how many inches you can see into the water or use a secchi disk.
- Surface scums
- Muddy
- Stained or other unusual appearance.

No Fact Sheet can give you the benefit of all the expertise and experience of a trained professional. For this reason, it is recommended that the local office of the [Natural Resource Conservation Service](#) is contacted whenever questions or concerns about the safety or maintenance of your pond structures. With the help of this Fact Sheet, you will know what to check and the right questions to ask to prevent a situation that is beyond the point of repair.

Yearly Pond Inspection

Date _____ (best to do same month of each year during growing season)

Pond Name _____ Inspected by _____

Note any problems or changes. Use flagging to mark potential problems. Take photos. Confer with NRCS or other knowledgeable professionals as needed.

The Dam

Crown (top)

- _____ Flat rather than higher in middle to shed water
- _____ Ruts
- _____ Grass cover thin and open to erosion
- _____ Animal burrows – mounds, tunnels, collapsed areas

Shoulders

- _____ Slumping or eroding

Slopes

- _____ Wave erosion on inside face
- _____ Animal burrows or vegetation signs (pathways for beaver and muskrats)
- _____ Trees or woody plants
- _____ Grass cover thin and open to erosion
- _____ Cattle trails or other bare soil
- _____ Animal burrows – mounds, tunnels, “slides” in grass due to beaver or muskrats
- _____ Cracking or slumping – Flag it and take photo. Beware of the possible danger if a section of the dam face breaks loose and slides
- _____ Damp or wet spots – Flag it. A new wet spot should not be ignored – seek advice

Primary spillway (overflow pipe or tower)

- _____ No trash rack to prevent floating debris from clogging intake and risk of floating debris is present
- _____ Signs of damage to the pipe or tower – corrosion, collapse etc.

Auxiliary spillway (Emergency overflow)

- _____ Grass cover thin and open to erosion
- _____ Rutting – by vehicles or cattle trail
- _____ Erosion – check entire spillway, especially the outside toe
- _____ Blockages or other changes

The Watershed

- _____ Grass cover thin and/or bare areas
- _____ Dirt roads and any eroding areas that will create muddiness in ponds.
- _____ Oil field activity. Describe: _____
- _____ Excess fertilizer use - More than needed as determined by a soil test
- _____ Improper storage or overapplication of animal manure – corrals, storage piles, and application to land in excess of soil test recommendations
- _____ Trash Dumps – may release toxic substances
- _____ Ponds higher in the watershed may be a source of undesirable fish species

The Basin

Shoreline

- _____ Areas filled in by sand and silt that has washed into the pond
- _____ Edge slumping or collapse
- _____ Edge erosion

Aquatic plant coverage

- _____ Percent of pond covered by shoreline emergent plants.
Name of plant(s): _____
- _____ Percent of pond occupied by submerged plants.
Name of plant(s): _____
- _____ Percent of pond covered by floating plants.
Name of plant(s): _____

Take photos (same location and direction of view each year) **OR** draw a bird's eye view sketch of the pond showing the areas covered by these three plant types.

Water appearance

- _____ Clear
- _____ Greenish. Estimate how many inches you can see into the water: _____
- _____ Surface scums
- _____ Muddy
- _____ Stained or other unusual appearance. Describe: _____

Seek advice and take action as needed to correct any problem observed

The Oklahoma Cooperative Extension Service

Bringing the University to You!

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.
- It provides practical, problem-oriented education

for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.

- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

Oklahoma State University, in compliance with Title VI and VII of the Civil Rights Act of 1964, Executive Order 11246 as amended, and Title IX of the Education Amendments of 1972 (Higher Education Act), the Americans with Disabilities Act of 1990, and other federal and state laws and regulations, does not discriminate on the basis of race, color, national origin, genetic information, sex, age, sexual orientation, gender identity, religion, disability, or status as a veteran, in any of its policies, practices or procedures. This provision includes, but is not limited to admissions, employment, financial aid, and educational services. The Director of Equal Opportunity, 408 Whitehurst, OSU, Stillwater, OK 74078-1035; Phone 405-744-5371; email: eeo@okstate.edu has been designated to handle inquiries regarding non-discrimination policies; Director of Equal Opportunity. Any person (student, faculty, or staff) who believes that discriminatory practices have been engaged in based on gender may discuss his or her concerns and file informal or formal complaints of possible violations of Title IX with OSU's Title IX Coordinator 405-744-9154.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Director of Oklahoma Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President of Agricultural Programs and has been prepared and distributed at a cost of 84 cents per copy. 0316 GH.